Model: CAT3

DC or AC Powered Microprocessor Controlled Transmitter

USER'S MANUAL

HP-312
October 2015

HOFFER FLOW CONTROLS, INC.
PERFECTING MEASUREMENT ™

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This manual has been provided as an aid in installing, connecting, calibrating, operating, and servicing this unit. Every precaution for accuracy has been taken in the preparation of this manual; however, HOFFER FLOW CONTROLS, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that may result from the use of the products in accordance with information contained in the manual.
HOFFER FLOW CONTROLS' policy is to provide a user manual for each item supplied. Therefore, all applicable user manuals should be examined before attempting to install or otherwise connect a number of related subsystems.

During installation, care must be taken to select the correct interconnecting wiring drawing. The choice of an incorrect connection drawing may result in damage to the system and/or one of the components.

Please review the complete model number of each item to be connected and locate the appropriate manual(s) and/or drawing(s). Identify all model numbers exactly before making any connections. A number of options and accessories may be added to the main instrument, which are not shown on the basic user wiring. Consult the appropriate option or accessory user manual before connecting it to the system. In many cases, a system wiring drawing is available and may be requested from HOFFER FLOW CONTROLS.

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Return Requests / Inquiries

Direct all warranty and repair requests/inquiries to the Hoffer Flow Controls Customer Service Department, telephone number (252) 331-1997 or 1-800-628-4584. BEFORE RETURNING ANY PRODUCT(S) TO HOFFER FLOW CONTROLS, PURCHASER MUST OBTAIN A RETURNED MATERIAL AUTHORIZATION (RMA) NUMBER FROM HOFFER FLOW CONTROLS' CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned RMA number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR CALIBRATIONS, consult HOFFER FLOW CONTROLS for current repair/ calibration charges. Have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of the product and
3. Repair instructions and/or specific problems relative to the product.

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HOFFER FLOW CONTROLS, INC. ("HFC") warrants HFC's products ("goods") described in the specifications incorporated in this manual to be free from defects in material and workmanship under normal use and service, but only if such goods have been properly selected for the service intended, properly installed and properly operated and maintained. This warranty shall extend for a period of one (1) year from the date of delivery to the original purchaser (or eighteen (18) months if the delivery to the original purchaser occurred outside the continental United States). This warranty is extended only to the original purchaser ("Purchaser"). *Purchaser's sole and exclusive remedy is the repair and/or replacement of nonconforming goods as provided in the following paragraphs.*

In the event Purchaser believes the goods are defective, the goods must be returned to HFC, transportation prepaid by Purchaser, within twelve (12) months after delivery of goods (or eighteen (18) months for goods delivered outside the continental United States) for inspection by HFC. If HFC's inspection determines that the workmanship or materials are defective, the goods will be either repaired or replaced, at HFC's sole determination, free of additional charge, and the goods will be returned, transportation paid by HFC, using the lowest cost transportation available.

Prior to returning the goods to HFC, Purchaser must obtain a Returned Material Authorization (RMA) Number from HFC's Customer Service Department within 30 days after discovery of a purported breach of warranty, but no later than the warranty period; otherwise, such claims shall be deemed waived. See the Return Requests/Inquiries Section of this manual.

If HFC's inspection reveals the goods are free of defects in material and workmanship or such inspection reveals the goods were improperly used, improperly installed, and/or improperly selected for service intended, HFC will notify the purchaser in writing and will deliver the goods back to Purchaser upon (i) receipt of Purchaser's written instructions and (ii) the cost of transportation. If Purchaser does not respond within thirty (30) days after notice from HFC, the goods will be disposed of in HFC's discretion.

HFC does not warrant these goods to meet the requirements of any safety code of any state, municipality, or other jurisdiction, and Purchaser assumes all risk and liability whatsoever resulting from the use thereof, whether used singly or in combination with other machines or apparatus.

This warranty shall not apply to any HFC goods or parts thereof, which have been repaired outside HFC's factory or altered in any way, or have been subject to misuse, negligence, or accident, or have not been operated in accordance with HFC's printed instructions or have been operated under conditions more severe than, or otherwise exceeding, those set forth in the specifications for such goods.

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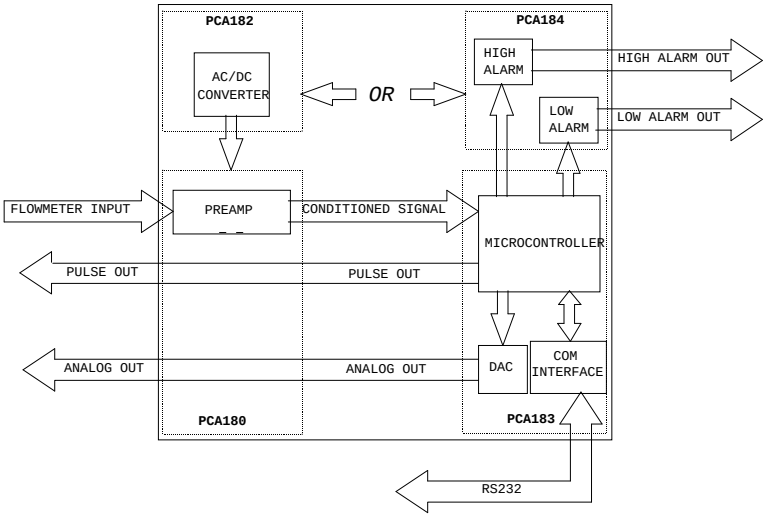
1. Introduction

The CAT3 is a versatile DC or AC powered microprocessor-based transmitter, which provides pulse output, analog output and High/Low flow alarm options. Up to 3 circuit boards may be installed to provide a variety of input/output options.

The flowmeter input circuitry will accept a variety of signal types including, low level sinusoidal, MCP/RF, pulse and contact closure. Optional 20-point linearization is available to correct for flowmeter non-linearities, improving overall system accuracy. The CAT3 is compatible with all Hoffer turbine flowmeters as well as the H.O.G. series positive displacement flowmeters.

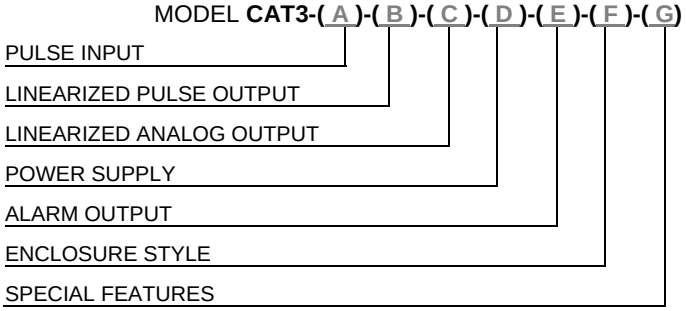
CAT3 Block Diagram



An RS232 communications port located under the top plate allows CAT3 to be remotely configured using DevConfig 3.0, a PC application program that is included with all units.

The standard unit is packaged in an extruded aluminum enclosure for wall mounting or may be mounted directly on a flowmeter using an optional NEMA 4X or EX enclosure. An optional bracket is also available for mounting on standard DIN rail.

1.1. Model Number Designation



PULSE INPUT
MODEL **CAT3-(A)-( )-( )-( )-( )-( )**

OPTION (A)

(1) MAG COIL, PULSE, DRY CONTACT
(2) MC3P
(3) ISOLATED PULSE, RPM, RPR AND HALL EFFECT COILS

LINEARIZED PULSE OUTPUT
MODEL **CAT3-( )-(B)-( )-( )-( )-( )**

OPTION (B)

(1) 0-5 TTL / CMOS
(2) OPEN COLLECTOR
(3) OPEN COLLECTOR WITH PULL UP TO V+
(4) AC SQUARE WAVE
(5) 0-10V SQUARE WAVE

LINEARIZED ANALOG OUTPUT
MODEL **CAT3-( )-( )-(C)-( )-( )-( )**

OPTION (C)

(1) 4-20 MA
(5) 1-5 VDC

POWER SUPPLY
MODEL **CAT3-( )-( )-( )-(D)-( )-( )-( )**

OPTION **(D)**

(DC) 13-30 VDC
(AC) 100-240 VAC

NOTE: WHEN (AC) IS SELECTED, THE ALARM OPTION IS NOT AVAILABLE. USE REMOTE ACC39B POWER SUPPLY IF REQUIRED.

ALARM OUTPUT

MODEL **CAT3-( )-( )-( )-( )-(E)-( )-( )**

OPTION (E)

(4) HIGH OPEN COLLECTOR

(5) HIGH TTL / CMOS

(6) HIGH RELAY ONE SPDT, CONTACT RATED @ 2A 30V

(7) LOW OPEN COLLECTOR

(8) LOW TTL / CMOS

(9) LOW RELAY ONE SPDT, CONTACT RATED @ 2A 30V

NOTE: WHEN ALARM OPTION IS SELECTED, (AC) POWER IS NOT AVAILABLE. USE REMOTE ACC39B POWER SUPPLY.

ENCLOSURE STYLE

MODEL **CAT3-( )-( )-( )-( )-(F)-( )**

OPTIONS (F)

(1) GENERAL PURPOSE.
2.6"L X 2.6"H X 2.6"W MINIMUM MOUNTING SPACE.

(D) 2" LONG DIN RAIL MOUNT SINGLE UNIT.
UP TO 20 CAT3 UNITS CAN BE MOUNTED ON A SINGLE RAIL. ADD 2" PER UNIT.

(E3) EXPLOSION-PROOF (ALL CONDUIT PORTS ARE ¾" FNPT)
- CSA/FM: CLASS I, DIV. 1, GR. BCD; CLASS II, DIV. 1, GR. EFG; CLASS III, TYPE 4X, IP66; CLASS 1 ZONE 1 AEx d IIB + H2, IP 66
- ATEX/IECEx: II 2 G Ex d IIB + H2, T1 – T6 Gb; IP66 T1-T5: -40°C ≤ Ta ≤ 85°C; T6: -40°C ≤ Ta ≤ 80°C

NOTE: FOR UL LISTED EXPLOSION-PROOF ENCLOSURES CONTACT FACTORY.

(E3M) EXPLOSION-PROOF (CONDUIT PORTS D2 & D3 = M20 THR'D; CONDUIT PORTS D1- ¾"FNPT)
- CSA/FM: CLASS I, DIV. 1, GR. BCD; CLASS II, DIV. 1, GR. EFG; CLASS III, TYPE 4X, IP66; CLASS 1 ZONE 1 AEx d IIB + H2, IP 66
- ATEX/IECEx: II 2 G Ex d IIB + H2, T1 – T6 Gb; IP66 T1-T5: -40°C ≤ Ta ≤ 85°C; T6: -40°C ≤ Ta ≤ 80°C

NOTE: FOR UL LISTED EXPLOSION-PROOF ENCLOSURES CONTACT FACTORY.

(E4)* EXPLOSION-PROOF - FOR USE WITH AC POWERED CAT ONLY
(NOT Ex d SYSTEM CERTIFIED)

- FM: CLASS I, DIV. 1, GR. ABCD; CLASS II/III, DIV. 1, GR. EFG, TYPE 4X
- CSA: CLASS I, DIV. 1, GR. ABCD; CLASS II, DIV. 1, GR. EFG; CLASS III, TYPE 4X, Ex d IIC; CLASS 1, ZONE 1, IP 66
- ATEX: Ex II 2GD, Ex d tD IIC, IP66/IP68
- IEC: Ex d IIC, IP68

NOTE: FOR UL LISTED EXPLOSION-PROOF ENCLOSURES CONTACT FACTORY.

***FOR Ex d CERTIFIED SYSTEM USE E6 OR E6M ENCLOSURE**

(E6) EXPLOSION-PROOF STAINLESS STEEL (ALL CONDUIT PORTS ARE ¾" FNPT)

- CSA/FM: CLASS I, DIV. 1, GR. BCD; CLASS II, DIV. 1, GR. EFG; CLASS III, TYPE 4X, IP66; CLASS 1 ZONE 1 AEx d IIB + H2, IP 66
- ATEX/IECEx: II 2 G Ex d IIB + H2, T1 – T6 Gb; IP66 T1-T5: -40°C ≤ Ta ≤ 85°C; T6: -40°C ≤ Ta ≤ 80°C

NOTE: FOR UL LISTED EXPLOSION-PROOF ENCLOSURES CONTACT FACTORY.

(E6M) EXPLOSION-PROOF STAINLESS STEEL **(M20 NOT AVAILABLE FOR CANADA)**
(CONDUIT PORTS T2 = M20 THR'D; CONDUIT PORTS T1- ¾" FNPT)

- CSA/FM: CLASS I, DIV. 1, GR. BCD; CLASS II, DIV. 1, GR. EFG; CLASS III, TYPE 4X, IP66; CLASS 1 ZONE 1 AEx d IIB + H2, IP 66
- ATEX/IECEx: II 2 G Ex d IIB + H2, T1 – T6 Gb; IP66 T1-T5: -40°C ≤ Ta ≤ 85°C; T6: -40°C ≤ Ta ≤ 80°C

NOTE: FOR UL LISTED EXPLOSION-PROOF ENCLOSURES CONTACT FACTORY.

SPECIAL FEATURES

MODEL CAT3-( )-( )-( )-( )-( )-( )-(G)

OPTIONS (G)

(CE) MARK REQUIRED FOR EUROPE

(CFX) 6.75" LONG RISER AND UNION FOR EXPLOSION-PROOF **SYSTEM CERTIFIED ENCLOSURES** MOUNTED ON TURBINE. USED WITH "X" RISER TURBINE OPTION.

NOTE: IF PROCESS TEMP IS < -40°C AND > 85°C, EX-PROOF ENCLOSURE MUST BE MOUNTED REMOTELY.

(SP) ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP

(MIL) DESIGNED TO MEET EMC STDS EN5011-1992 AND EN61326-1:1997

NOTES:
1. IF ENCLOSURE IS MOUNTED ON TURBINE FLOWMETER, RISER MUST BE SPECIFIED ON METER.
2. PULSE SCALING IS SUPPLIED AS A STANDARD IN THE BASE PRISE AND IS SCALED TO THE UNIT MEASURE.
3. WINDOWS® BASED SETUP AND CABLE KIT CONSISTS OF:
   1 EA. HIT2A-301
   1EA. CABLE MODEL 26886
   1 EA. WINDOWS® BASED SETUP DISC

   IF THE CAT IS SHIPPED UN-CALIBRATED, THIS MUST BE ORDERED TO CALIBRATE OR RE-CALIBRATE IN THE FIELD.

2. Specifications

General Specifications

Input Signal Type:	Magnetic pick up, MCP pick up, Contact Closure, Pulse
Input Frequency Range:	0.2 Hz to 4 KHz
Signal Level:	10 mV rms to 30 Vdc
Power Supply:	13-30 Vdc (Reverse polarity protected) 100-240 Vac (Fuse rating 0.5A, 250 Vac)
Analog Output:	4-20mA, 1-5V
Analog Output Response Time:	1/8 sec.*
Load Resistance:	Max 650 Ohms at 24 Vdc
Accuracy:	+/- 0.02% of full scale @ 20° C
Temperature Drift:	40ppm/deg C
Pulse Output:	0-5, 0-10V, Open Collector, AC square Internal pull-up resistor 10k Ohms Recommended load min. 50k Ohms
Maximum Pulse Frequency:	1, 2, 4, 8, 100, 50% Duty Cycle
Pulse Scaling:	Per flow unit of measure, divide by 1, 10, 100
Hi/Lo Alarm:	Relay (2A, 30 Vdc), 0-5V, Open Collector (0.5A, 30 Vdc)
Communications:	RS232 port for Configuration and diagnostics
Operating Temperature:	-40 to 85 C^{o}
Humidity:	0-90% Non-condensing
Enclosure:	Extruded aluminum DIN rail mount Explosion Proof
Regulatory:	CE compliant

*Limited by signal frequency and MST settings. Refer to Section 3.4.

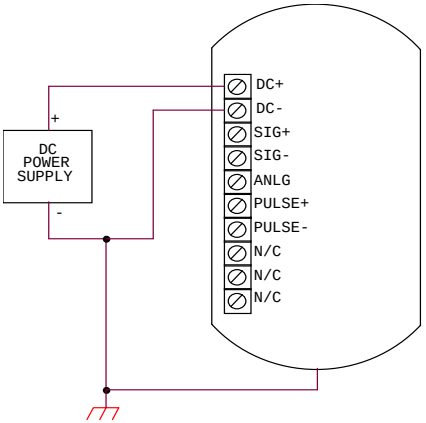
Options

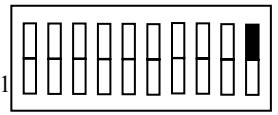
12 Point Linearization

3. Installation and Operation

3.1. Power Supply

DC Power (13-30 VDC)

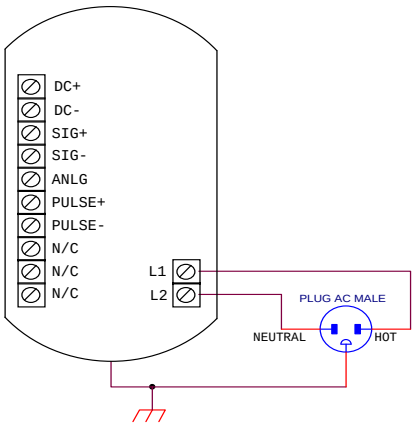


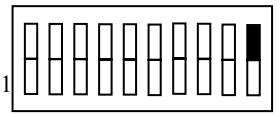


PCA180
SW2

AC Power (100-240 VAC)

AC power for CAT3 requires an optional circuit board, PCA182. The Alarm option (PCA184) is not available when the AC Power option is equipped.



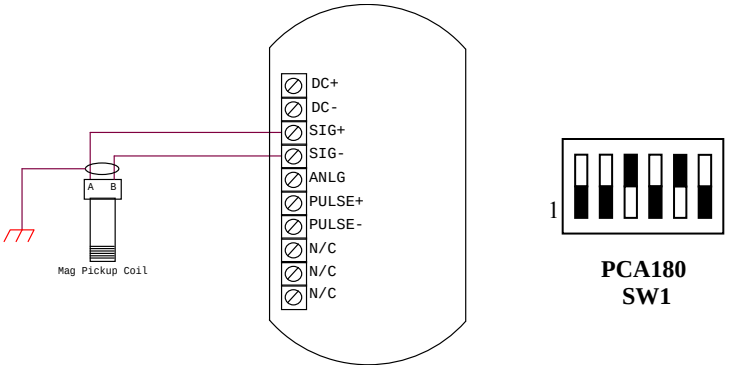


PCA180
SW2

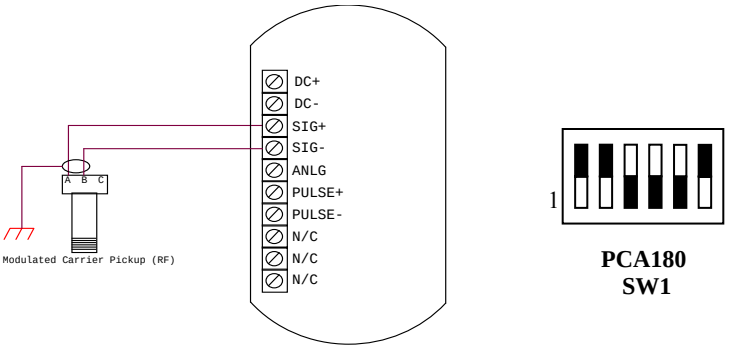
3.2. Flowmeter Input

The Preamp circuitry for conditioning the flow signal is located on PCA180. The following drawings illustrate typical connections and switch settings on PCA180 for various input signals.

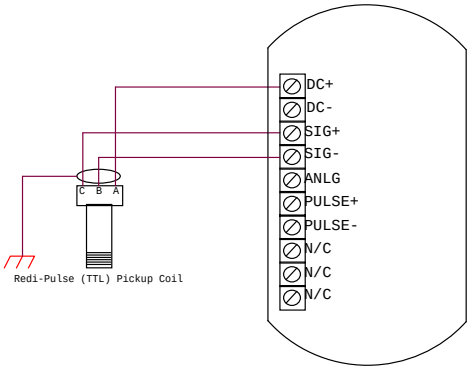
Magnetic Pickup Coil

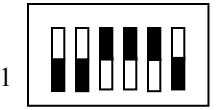


MCP/RF Coil



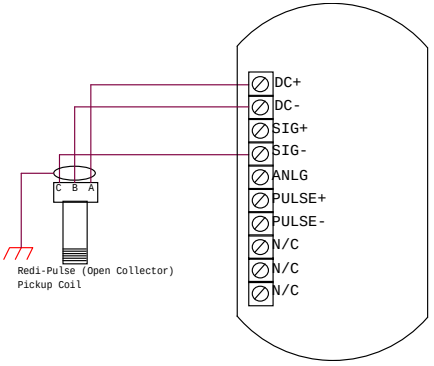
Redi-Pulse (TTL Pulse)

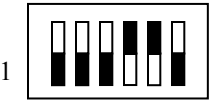




PCA180
SW1

Redi-Pulse (Open Collector)



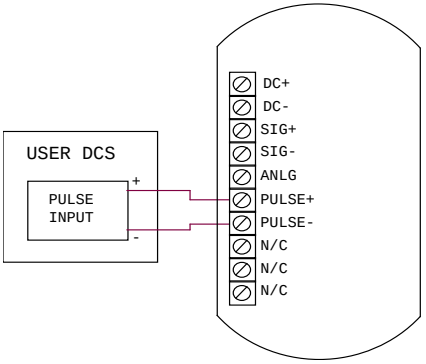


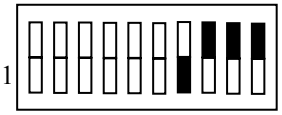
PCA180
SW1

3.3. Pulse Output

CAT3 provides a Pulse Output option that is scaled per flow unit of measure by a factor of 1, 10 or 100. Pulse output frequency varies with flow rate. The maximum frequency can be set at 1, 2, 4, 8, 100 Hz. The following drawings illustrate typical connections and switch settings for various pulse output options.

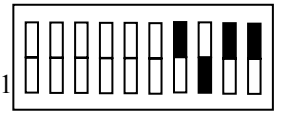
TTL(0-5V), 0-10V, High Level (DC In), AC Square





PCA180
SW2

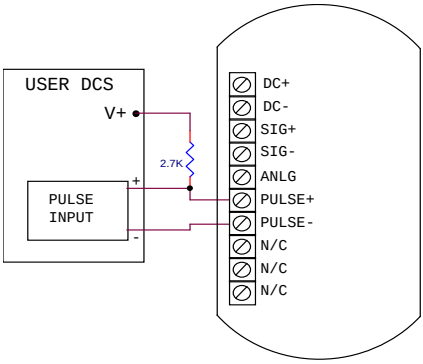
TTL(0-5V), 0-10V, AC Square

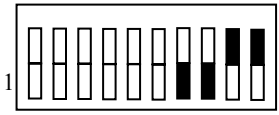


PCA180
SW2

High Level Pulse, AC Square

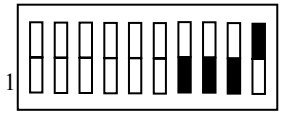
Open Collector, Isolated Pulse





PCA180
SW2

Open Collector



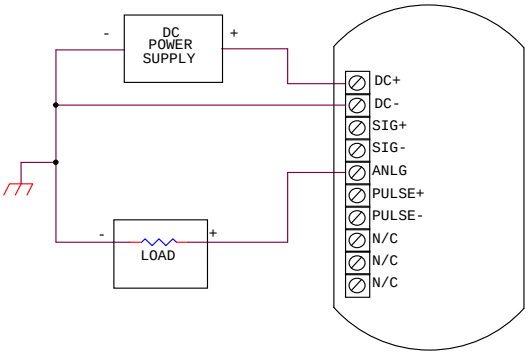
PCA180
SW2

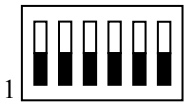
Isolated Pulse

3.4. Analog Output

CAT3 provides an Analog Output option that will output an analog current or voltage that is proportional to the flow rate.

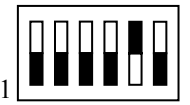
Analog Output





PCA183
SW1

4–20 mA Output



PCA183
SW1

1-5 V Output

The Microcontroller, located on PCA183, accepts the square-wave output of the preamplifier and performs all of the calculations that are required to control the Loop Driver. After measuring the frequency of the square-wave, the Microcontroller uses the following equations to compute the flow rate and current.

$$flowrate = \frac{frequency}{Kfactor} x60^{FM} xCF$$

Where:

Kfactor = Is dependent on the Flow Calculation Method setting and is either the Average K-Factor or the Linearized K-Factor from the Frequency / K-Factor table.
FM = Is the Flow rate Units setting of 0, 1, or 2. Where "0" is for Seconds, "1" is for Minutes, and "2" is for Hours.
CF = Is the Correction Factor setting.

$$current = 4mA + \left(16mAx \frac{flowrate}{AF} \right)$$

Where:

AF = Is the 20 mA maximum Flow rate value.

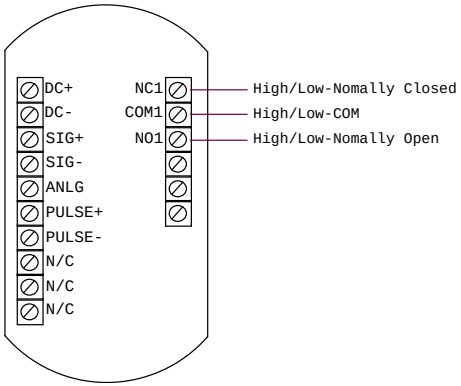
If the calculated flowrate is greater than the AF setting, the current will be set to 24mA to indicate an "Over-range" condition. After calculating the current, the Microcontroller digitally sends the current information to the Loop Driver. The loop driver, located on PCA183, uses the digital information sent to it by the Microcontroller to set the current of the loop. The Loop Driver also supplies power to the Microcontroller.

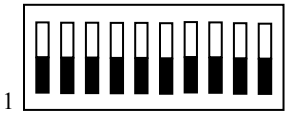
The analog output response time to reach steady state due to a change in the flow rate is approximately 1/8 of a second. When flow stops, the time for the analog output to return to 4 mA will be between .25 and 8 seconds, depending on the Maximum Sample Time (MST) setting. MST is adjusted using the NB= (DATA) command, where NB is a value between 1 and 80. The default MST setting is NB= 1. Adjusting the MST is only recommended for low flow applications where the minimum input frequency is below 1 Hz.

3.5 Alarm Outputs

CAT3 provides an optional High/Low Flow Alarm feature. Alarms require an optional circuit board, PCA184. The Alarm option is not available when the AC Power option is equipped. The drawings below illustrate the typical connections and switch settings for various alarm options.

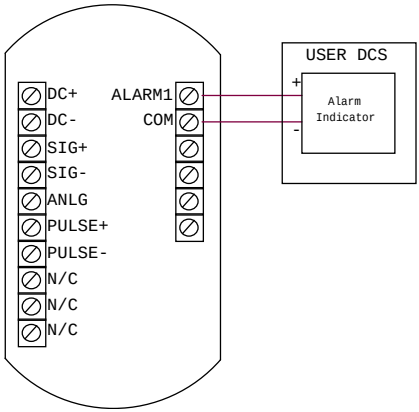
Hi/Lo Alarm Relay

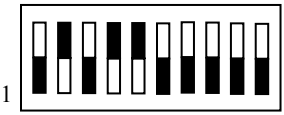




PCA184
SW1

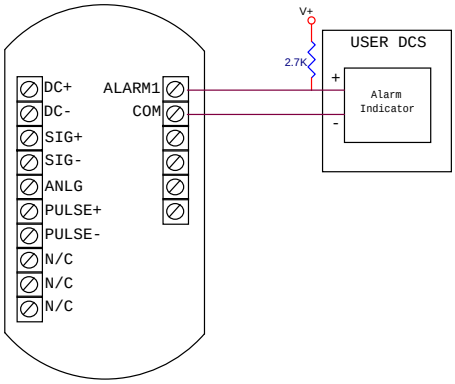
Hi/Lo Alarm TTL(0-5V)

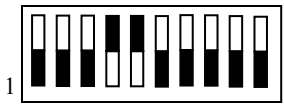




PCA184
SW1

Hi/Lo Alarm Open Collector





PCA184
SW1

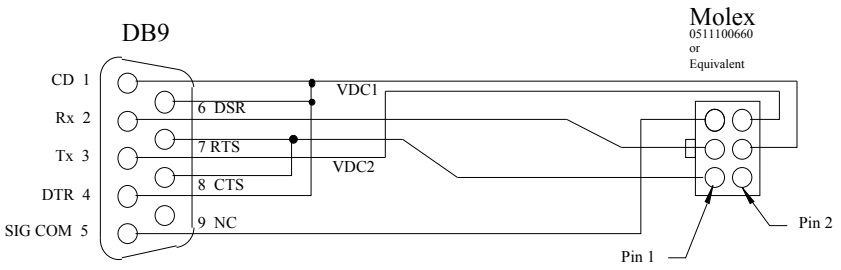
3.6 Communications Port

CAT3 is equipped with RS232 serial communication port for changing CAT3 configuration, diagnostics functions, and flow monitoring. Hoffer communication program DevConfig 3.0 must be used to communicate with CAT3.

The RS232 serial port connector is located under the top plate of CAT3 and may be accessed by removing the two screws from the top plate. A matching connector is provided with HOFFER HIT2A-301 Communications Cable. CAT3 unit has to be powered from external supply in order to be able to communicate. Additional power for CAT3 communication circuitry is supplied by the RS232 serial port of the computer/terminal. COM port settings must be set as follows:

Baud Rate:	2400
Data Bits:	8
Parity:	None
Stop bits:	1
Handshaking:	None

HOFFER HIT2A-301 Communications Cable



3.7 Wiring

When installing CAT3, it is a good practice to use shielded cables for all input and output signals. The shield should be connected to the earth ground lug on the CAT3. The shield on the opposite end of the cable should be left open.

This wiring practice is mandatory in order to comply with the requirements for Electromagnetic Compatibility, as per EMC-Directive 89/336/EEC of the Council of European Community.

Appendix A – Default Configuration

Factory default configuration:

FIELD	***Value***
FLOW CALC. METHOD	0 *(Average)*
K-FACTOR DECIMAL	3
AVERGAE K-FACTOR	1.00
NUMBER OF POINTS IN K-TABLE	12
FREQUENCY 01	4999.981
FREQUENCY 02	4999.982
FREQUENCY 03	4999.983
FREQUENCY 04	4999.984
FREQUENCY 05	4999.985
FREQUENCY 06	4999.986
FREQUENCY 07	4999.987
FREQUENCY 08	4999.988
FREQUENCY 09	4999.989
FREQUENCY 10	4999.990
FREQUENCY 11	4999.991
FREQUENCY 12	4999.992
K-FACTOR 01	1.00
K-FACTOR 02	1.00
K-FACTOR 03	1.00
K-FACTOR 04	1.00
K-FACTOR 05	1.00
K-FACTOR 06	1.00
K-FACTOR 07	1.00
K-FACTOR 08	1.00
K-FACTOR 09	1.00
K-FACTOR 10	1.00
K-FACTOR 11	1.00
K-FACTOR 12	1.00
MEASURING UNITS	GAL
FLOW RATE TIME UNITS	MIN
MAX SAMPLE TIME	01
ANALOG OUTPUT LOW	00000.000
ANALOG OUTPUT HIGH	99.999
PULSE SCALE	OFF
PULSE FREQUENCY	100
ALARM FUNCTION	Off
ALARM LEVEL	99999.981